

Invest in DeFi, Redefine Your Yield



Version 1.0



Paribus is a cross-chain decentralized finance protocol aiming to unlock underlying liquidity for a variety of conventional and unconventional digital assets.

If it can be verified, it can be sold. If it can be sold, there is intrinsic value. If there is intrinsic value, this value can be leveraged. Paribus is the protocol that offers DeFi holders and investors a platform to extend the reach of their digital assets and positions.

In stark contrast to traditional finance, Decentralized Finance instruments have quickly created virtual economies that are continually being developed, refined and innovated upon. As it evolves at a blistering pace, the userbase continues to grow–exposing flaws as well as opportunities. There is both flexibility and vulner-ability to these products and the network effect is undeniable as more users flock to the latest aggregator, compounder and the like. While forward-looking, Paribus is focused on existing applications in both non-fungible and fungible tokens. One of the core objectives of Paribus is to explore financial tools and products for NFTs.

The primary gateway tool to empower NFT owners is lending, which allows them to gain access to liquidity and capital by simply locking their assets as collateral. Legacy markets do not typically collateralize non-fungible assets, save for highly specialized services. In DeFi however, NFT borrowing and lending as a mainstream service is a challenging but self-evident proposition. Certainly, there are additional applications, such as renting an asset to another user for a given period of time and even derivative style products, offered OTC. There are also opportunities to lend and borrow with liquidity positions. This would effectively allow users the opportunity to generate yield while earning liquidity provider rewards. These applications are newer in scope but emerging drivers; propelling the space forward.

While Paribus acknowledges the more novel concepts that the chain agnostic power of Cardano and the existing toolkit of Ethereum can bring, we have chosen to innovate while staying in our lane. Our research has led us to a place where a cross-chain, interoperable, Cardano powered marketplace that enables NFT lending, staking, synthetic assets, and the opportunity to leverage liquidity positions is comprehensive and potent.

The aim of Paribus is to provide a consolidated destination in which users can easily and freely participate in this financial revolution. To date, Dexes and lending platforms have led the charge while exotics are slowly gaining traction. For Paribus, we are building upon what has been built and continuing to iterate forward in the face of existing opportunities and in anticipation of demand. Non-fungible tokens, liquidity positions and synthetic assets deserve DeFi applications wherein holders have the opportunity to truly capitalize on their value.



Introduction

Cryptocurrency markets have grown from \$0 to over \$2.5T in a matter of 12 years since Bitcoin's inception. One of the fastest growing use cases, currently, for crypto assets is Decentralized Finance (DeFi). DeFi has been growing at an exponential rate since "DeFi Summer" of 2020. The growth has fueled the inception and introduction of a plethora of dApps that are attempting to solve various challenges users today are facing.

The rapid evolution of DeFi has created pain points and contributed to markets that remain underserved. Unconventional crypto assets regularly emerge and remain underutilized. Consider NFTs, for instance. Presently, there are limited ways of generating passive income from NFTs. To generate any earning power, generally requires them to be traded on secondary markets or remain idle in wallets whilst coming to represent opportunity cost. Paribus is addressing this situation by providing a way to make stagnant assets productive.

DeFi assets have differential value, and instilling interoperability is a rather uphill task. Again, to consider NFTs, it's clear that their value is subjective which often makes it difficult to liquidate them using conventional means. Similarly, yield-bearing assets can often become illiquid, while synthetics are subject to systemic protocol risks.

To resolve these issues, the foremost necessity is to transform these assets, such that they suit the liquid and effective market conditions. Paribus is doing exactly that, by making non-conventional assets more interoperable, predictable, and reliable. The protocol brings you a lending market where you can utilize your stagnant assets smoothly, efficiently, and with promising returns.

We now have dApps that can unlock a range of features for investors in the market to earn passive income while watching their underlying assets grow with general cryptocurrency demand; thus preventing exit and enticing entry into crypto markets. However, there are gaps in the market that still need solutions to lower barriers and unlock further liquidity. Liquidity is the ultimate fuel for crypto or, in fact, any market to allow for growth and innovation. DeFi, can be siloed or "wall gardened" in that it is chain dependent. Cross-chain liquidity is a must and natural evolution for the market overall. We see and believe below listed areas need improvements and work hence our product Paribus;

- Chain agnostic lending/borrowing Virtual Land Collaterals
- NFT collateral-based loans

Synthetic assets

Crypto assets till very recently were made up of "base assets" such as i.e. ADA, ETH, BTC. However, with the advent of NFTs and the demand growth of this ecosystem, whether in the form of unique art, audio, even GIFs or in the form of "virtual lands", there is now a new gap to be filled and boost overall liquidity across the market.

In the following sections of this paper we aim to introduce a protocol that has one main goal which is to unlock liquidity. We aim to support an approved list of liquid assets across multiple chains and allow users to tap into a frictionless comprehensive ecosystem built on Cardano, which we believe is the natural next evolution of blockchains.



The Paribus Proposition

Paribus is a Cardano-based lending/borrowing platform that aims to support conventional and unconventional crypto assets to allow for its users to unlock liquidity and interact with the markets without having to liquidate assets. The principle we follow and hold utmost importance at Paribus is that; *"If it can be sold, there is a market value. If it has value, it can be modeled".*

Our proposition and philosophy is to be able to support assets such as USDT (ERC20, BEP20, TR20) but also expand our capabilities to support assets such as an NFT for a piece of art or Virtual Land based on, for example Decentraland.

The concept of on-chain value is constantly changing as innovators discover transformational ways to store, represent, leverage and exploit this value. In order to unlock the true potential of these assets, they must evolve in terms of reach. Decentralized financial products are not siloed; they are inclusive, borderless and need to be truly interoperable financial instruments, capable of being used within DeFi protocols, on any chain.

Paribus, like a majority of DeFi dApps, is built on the shoulders of those who have come before us. Take *yearn.finance* and all successor dApps that extended the idea. Paribus operates using "pools of assets" with algorithmically derived interest rates, based on the supply and demand for a given asset. We have taken the interest modeling approach from Compound and expanded the idea to go beyond coins and tokens as mentioned.

As DeFi primitives come on-chain, it is revamping traditional investment as new utilities are being derived from principles that have remained unchanged for decades. Paribus has identified opportunities in the following areas:

- Liquidity positions
 -- structured as components of investment strategies
- Synthetic assets
 -- backed by on-chain collateral
- Digital art

- Virtual land
- Music

Crypto collectibles

- Domain names
 -- Ethereum Name Service-ENS
- Smart contract insurance policies

THE PARIBUS PROTOCOL BRINGS ALL OF THESE FORCES TOGETHER, OFFERING DEFI HOLDERS AND INVESTORS A PLATFORM TO EXTEND THE REACH OF THEIR DIGITAL ASSETS AND POSITIONS TO REALIZE EARNING POWER.



Paribus Pursuit

Paribus will endeavor to offer a wide range of features that will ultimately add strength to its value proposition as one of the earliest DeFi protocols on Cardano blockchain.

Due to Cardano's nature and ability to plug into existing blockchains, Paribus by default will utilize and extend this capability to unlock liquidity across chains across a spectrum of assets. Some of the assets Paribus will support include; NFTs, Virtual Lands, Synthetics, and of course more traditional assets such as ADA, ETH, and DOT. The full list of assets is available in later sections of this paper.

Non-fungible Tokens (NFTs) have become extremely popular and demand for these digital assets are increasing exponentially while capturing mainstream media attention. Possibility to tokenize assets of value, regardless of their physical appearance and/or features, brings new opportunities as well as challenges. Paribus aims to solve one of these challenges and amplify the economical value of these tokens with enhanced liquidity and options to utilize this economical strength without having to sell the NFT outright. NFT owners will be able to unlock liquidity via collateralized loans against their NFT assets to finance additional ventures such as; trading, investing and more.

Virtual Land is a growing phenomenon with land going for as much as \$900,000 per a recent Decentraland sale. As demand for these assets grows with the innovations from the VR industry added into the mix, it quickly becomes an interesting asset class for DeFi protocols to be able to support. Paribus aims to address exactly this, by proposing a suite of SmartContracts which allow for collateralization with Virtual Lands. Given the infancy of the Cardano ecosystem on lack of agreed standards for this asset type, Paribus will contribute and put forward ideas that will serve the purpose of unlocking liquidity through these assets in the form of borrowing and lending. Metadata is one area we will work to innovate and bring into NFT standards for Virtual Lands.

Synthetics and LP Tokens are an additional dimension that has quickly become a success via platforms such as Synthetix and Uniswap. The generation of wealth is ever growing with both assets. We believe that as demand and user base grows for cryptocurrencies we will witness a whole new generation of cryptocurrency investors of which a new portion will go onto become savvy DeFi users. To serve more sophisticated use cases with Synthetics and LP tokens, Paribus will build a product line for borrowing and lending to further leverage the underlying assets.

The above mentioned products will be deeply integrated into the PBX native token. PBX will allow for reduced fee structure across all our products, profit sharing for liquidity providers and stakers and of course power to govern through our planned DAO structure.

Paribus Capture

As per nature of decentralized and DAO projects and in the spirit of open source development, all of Paribus source code will be made public and free to use after audits and rigorous testing. Paribus will of course inherit all de facto standards of decentralized dApps such as being non-custodial, trustless, permissionless, and of course censorship resistance. We have identified an array of basic applications, enumerated below:

- NFT collateral-based loans Borrow against investments to free up capital
- NFT Staking Pool value with other like-NFTs to earning yield on these assets
- P2P and Pooled Lending NFT ownership becomes flexible and optimized
- LP collateral-based loans Borrow against AMM liquidity positions
- LP staking Staking pools for LP tokens from multiple blockchain liquidity pools
- Lend, borrow or stake synthetic assets capital efficiency, flexibility, cross-chain
- PBX token profit sharing earn fees collected by the network, tiered staking

Paribus's features and protocol are designed to evolve with new crypto asset classes, capturing the value stored in the emerging universe of interconnected blockchains.



Cardano will allow the Paribus protocol to remain chain agnostic and simultaneously connect innumerable assets across multiple blockchains. Cardano's interoperability removes restrictions and allows value to flow freely.





NFTs & Synthetics:

The Fungible and Non-Fungible

Tokens are blockchain assets which are managed and housed using cryptographic addresses and smart contract technologies. Many of them share the same properties and can be categorized under a common standard, most notably, ERC-20. ERC-20 tokens are fungible and easily exchanged, like for like.



They are largely responsible for the asset class that is crypto as early on, they mimicked money but with preferred features, such as censorship resistance and non-inflationary supplies.

On the other hand, non-fungible tokens or NFTs have varying sets of properties and a uniqueness which makes them proverbially "one of a kind." One can not trade one-for-one while one Bitcoin is always one Bitcoin. Thus, NFTs can have associated values which only a marketplace can define. Some examples of these would be:

- 🗸 🗸 Digital art
- 🗸 Virtual land
- 🗸 Music
- Crypto collectibles
- Customizable Gaming Rewards/In-app use
- Domain names -- Ethereum Name Service-ENS
- Smart contract insurance policies

While speculators would be interested in naming a price and having a fluid exchange, the existing opportunities to do so are largely lacking. Dexes and automated market making solutions do not currently offer implementations for the exchange of these unique assets and have been relegated to static ownership until sold on a P2P marketplace.



Synthesizing NFTs

Compared to the traditional crypto asset market, the non-fungible token (NFT) ecosystem is severely underdeveloped in both application and market cap–large-ly due to immaturity and market size has become difficult to quantify.

Since the advent of the Cryptokitties, NFTs have been lying in wait, quietly building and in recent months, have flirted on the precipice of exploding. Higher profile projects with real world ties have come to market with many more on the horizon. To pundits, we have yet to scratch the surface. In the art world, the fundamental argument that NFTs are the only tamper proof, fully verifiable assets on the planet is not unsound. The applications for the more rigorous, such as real estate and even financial products wrapped as NFTs have more tangible merit and immediate use cases.

We have also seen progress in ways most have missed. For example, wrapped Cryptokitties are available on Uniswap for roughly two years and there is currently a wrapped kitties pool. The beauty of these synthetic assets is their ability to be both individuated or bundled. Wrapped kitties can be traded for the WCK token on Uniswap and users have attempted to trade non-kitty NFTs for the WCK token. While it was perhaps ahead of its time, the application and progress of the inevitable has been upon us for some time.

What experts have stated for some time now is that there must be the opportunity to leverage these assets as crypto has evolved to include debt markets for a number of altcoins. For the NFT universe to really come into its own, these assets need to be collateralized and borrowed against or even leased.

Valuation Metrics

Traditionally, valuations are derived from historical purchases and comparables that exist in a fluid marketplace. Moreover, this value is denominated in an agreed upon currency. NFTs do not have this history and may be valued against USD or Ethereum or any number of assets, creating a moving target out of a moving target. Essentially, NFTs need price discovery and certainly this is happening as the number of enthusiasts and subject matter experts grow in concert with the rising number of speculators. In due course, the market will ultimately determine the value i.e. the lending and borrowing power of an asset which adds to the importance of creating a market. Fair value is determined by fair markets.

Paribus's NFT loan markets could go a long way in determining the realized value of NFTs and crypto is an ideal breeding group as it brims with risk loving speculators. Users can ultimately determine the exchange currency, the loan duration, the loan-to-value ratio and interest. A rare item may have consensus value but it is worth knowing what someone is willing to lend against it and for how long. In due course, water will find its level.



Leasing NFTs

The ability to rent out an NFT has garnered interest and portends a large market place. While it may initially inspire a "huh?" the opportunity to try out new things, experiment with games or deploy capital leveraging alternative assets is considerable, given a modicum of efficiency in the market. The evolution would likely mirror the loan markets with added emphasis on the characteristics of the asset itself. Current trends and market demands would likely exert great influence on the market. While Paribus is following this development, there are many variables to consider, such as duration of lease and the willingness lessor's to subject themselves to what would likely be customized agreements until the market takes shape.

Conclusion

The market support for NFTs is growing asymmetrically and they deserve their seat at the DeFi table. The lending and leasing marketplaces will derive income generating opportunities for holders of these new and verifiable assets. Paribus believes that in time, the NFT markets will find fair market value and become as liquid as most tradeable cryptocurrencies.

Powering Synthetics

Traditional lending markets silo individuals thus limiting available resources and products. Paribus pools the collective resources of participants to create a single resource in order to amplify liquidity and create a vibrant marketplace. While non-fungible makes for great copy, there is a need for fungibility that can gather and pool resources. Flexible deposits, withdrawals, buying, selling, borrowing and lending are actuated instantly and unlike traditional money markets, no maturity is required for loans. This can simply not happen without like-for-like synthetic assets. Valuating unique assets requires reference in order to gain exposure to the underlying asset so interest can accrue accordingly. With enough borrowing demand to warrant the marketplace, interest can be realized by the passive hold-ing of an asset. This is resultant from the exposure to an underlying asset.

In traditional markets, synthetics assets are commonplace and used to mirror an underlying asset, be it a stock or currency. Theoretically, most anything can be replicated in a synthetic manner, so long as there is no requirement for the physical asset in order to settle a trade. One can trade an asset if the rules are in place that allow for a mirrored asset to substitute for the real thing. In turn, single assets can have virtually unlimited instruments as permutations in legacy finance abounds. In crypto, SNX or Synthetix created synthetic crypto-assets, utilizing oracles for accurate price information which allows for them to be traded at great multiples and opens the door for derivatives.



- 🗸 Lend, borrow or stake synthetic assets
- Increase capital efficiency–earn yield from multiple sources
- Investment flexibility-gain exposure to additional assets
- Cross-chain: Powered by Polkadot, passive holdings can be applied anywhere

The application of synthetic assets has given crypto an unprecedented level of growth and earning opportunities. Crypto synthetics allow individuals to gain exposure to commodities without having to hold the asset.



Conclusion

Unlike NFTs, holders of a given crypto asset will be able to put their tokens to work by supplying the Paribus network and earning interest. This is passive and virtually riskless and rewarded in the form of the denominated token paired. Where there is inherent value, this value can be leveraged as users retain upside of a given asset while creating additional returns via Paribus' lending marketplace. This is trustless and requires no active management on the part of the user. The speed and fee structure of Cardano offers decided efficiencies for any entity, dApp or token holder.

The Paribus protocol provides revenue for supporters of a given asset and does so without restrictions.



Paribus Users

Paribus is made up of several different user types. The section clarifies the inherent characteristics of assets along with Paribus user types and their roles within the platform.

→ Lenders

The lender is the key in any DeFi platform. Majority of the time these users are what are known as "HODL'ers" within the cryptocurrency space. They have no plans to outright sell their crypto assets. Paribus will be an additional outlet to this user group to earn a passive income while their underlying assets appreciate in value over time. Lenders can be thought of as liquidity providers within the ecosystem and earn interest in return for doing so. The platform will provide Deposit APR(%) based on factors such as utilization rate. Lenders can at a rough level estimate their earnings based on the Deposit APR(%) for a given asset.

Borrowers

Paribus will operate strictly as a collateralized loan platform. Meaning any borrower must deposit asset(s) in order to borrow against it. As a result borrowers are indirectly also liquidity providers to assure the platform is sustainable and self-sufficient. Every borrower is subject to paying a small one-time fixed platform fee as well as the interest accrued over the period of loan. The fee mechanism is detailed in the latter section of this paper.





Interest Rate Modeling

Paribus operates autonomously based on variables and changes within its pools after each transaction. One of the key values that determines the borrow and deposit rates is Utilization Ratios, **U**. Utilization ratio is calculated per pool token, which can be seen below.

Ua= Borrowsa / (Casha + Borrowsa- Reservesa)

Supply Rate is determined through the following formula.

Supply Interest Ratea = Borrowing Interest Ratea * Ua * (1-Reserve Factora)

Breaking down the above formula, 'a' is the token/asset pool. **Reserve Factor**, is the percentage of interest paid by borrowers which the protocol can use to protect all liquidity suppliers from borrower defaults. Hence the name "reserve". This value is subject to change by the Paribus team initially depending on market conditions for a given asset. Going forward it will be adjusted via proposals through the Governance module using PBX tokens. The constant 1 is an artbitrality hardcoded value which again is subject to change depending on market conditions for a given asset.

Supply Interest Rate, as per above formula requires a key value which is denoted under **"Borrowing Interest Rate"** for assets on Paribus. The calculation of borrowing interest rate is noted below.

Borrow Interest Rate = Multiplier * U + Base Rate

Breaking down the formula, *Multiplier* denotes the rate of increase in interest rate which is determined off our all important Utilization Rate (U). Lastly Base Rate represents the minimum borrowing rate per year. This value is hardcoded but subject to changes via Governance and PBX tokens.

Based on above formulas any asset that has a high utilization rate will in return provide a high deposit APR, thus better returns for those staking their assets in particular token markets. However, as LTV is limited, it may be difficult to maintain a high utilization rate for all tokens. As such, the overall utilization rate that we consider to be ideal is approximately 50%.

The above formulas will be utilized further in our roadmap to provide borrowing and deposit APRs for unconventional assets such as NFTs, Virtual Lands and LP tokens. However, aggressive interest rate models such as **"Polynomial"** and/or **"Index"** will be plugged in where necessary to assure the system is reactive. Given the nature of NFTs, LPs and Virtual Lands, they can be riskier assets than conventional crypto assets. Aforementioned models will increase interest rates aggressively to incentivize individuals to repay quickly thus enhancing and reassuring the sustainability and positive cash flow of the protocol.



Jump Rate Model

Certain assets utilise a model called "Jump Rate" which is derived from the famous jump-diffusion model introduced by Robert Cox Merton an American economist. The idea behind jump models in general is to introduce rate hikes exponentially should certain market conditions be met i.e. utilisation rate goes above a certain threshold. Such rises in interest rates in turn builds a positive feedback loop for liquidity for any given monetary policy.

A jump rate has two standard parameters:



Base rate per year, the minimum borrowing rate

V

Multiplier per year, the rate of increase in interest rate with respect to utilization

However, it introduces two new parameters:



Kink, the point in the model in which the model follows the jump multiplier



Jump Multiplier Per Year, the rate of increase in interest rate with respect to utilization after the "kink" utilization

The borrow rate is worked out differently under this model than the aforementioned standard interest rate model. See below for formula under Jump Rate model:

Borrow Interest Rate = Multiplier * min(Ua,Kink) + Jump Multiplier * max(0,Ua-Kink) + Base Rate

Polynomial and Index Models

The above formulas will be utilized within our MVP for conventional assets as mentioned. However, for unconventional assets such as NFTs, Virtual Lands and LP tokens we need more aggressive interest rate models such as **"Polynomial"** and/or **"Index"**. These models are currently being worked on by our team and will be plugged in to assure the system is reactive and sensitive against less liquid and riskier assets. Aforementioned models will increase interest rates aggressively to incentivize individuals to repay quickly thus enhancing and reassuring the sustainability and positive cash flow of the protocol.



The Controller smart contract is used to establish the interactions between the other associated smart contracts and the protocol. The controller is used to whitelist different assets and enable their use in Paribus. The whitelisting process is needed to ensure that the market for an asset is liquid enough, that a valid oracle price feed and collateral factor is given.

Oracles are needed to provide the protocol with a reliable decentralized price feed.

Liquidators ensure that outstanding loans are liquidated if the value of the collateral deposited is no longer sufficient to cover the loan.

pTokens represent the user balance in the paribus ecosystem. They allow you to earn interest or serve as collateral based on the value of the underlying asset.

Interest Rate Strategy is a smart contract that implements the various interest rate strategies used in the protocol.



Cross-Chain Compatibility

Cross chain capability plays a huge part in crypto markets and directly affects liquidity. As Paribus aims to unlock liquidity, cross-chain compatibility is one of the imperative features we are hard at work on. We have decided to utilize bridging technology that is used and tested in abundance within the crypto space. However, where applicable we are looking to utilize Inter-Blockchain Communication (IBC) protocol to connect to multi-verse ecosystems such as Cosmos through our partners that have integrated the protocol into their "chains".

Below diagram provides a high level overview of networks that is on our roadmap to be integrated with.



The chosen chains of integration provide a decent level of standardization in terms of tokens and tech stack and boast a generous amount of liquidity.



Implementation

All SmartContracts that control and mutate data within Paribus will be open sources and verified on relevant scanner(s). Given our roadmap plans to become a DAO, we as the team behind Paribus, aim to make ourselves obsolete in the next 5 years and hand over control of the protocol into PBX holders hands via Governance.

Liquidations

Liquidations are in place to keep the system self-sufficient and sustainable. When a users borrowing balance exceeds their total collateral value due to underlying asset falling price and/or borrowed assets price increased in value then liquidations could be executed by machines, other dApps or humans through the liquidate function on "Liquidation Manager" contract. Calling this function will exchange the invoking party's assets for the borrower's collateral at a discounted rate in comparison to the general market.

Price Feeds

Paribus will utilize the most reliable and trustworthy price feeds from Oracles to assure asset exchange rates reflect their true value. Paribus will amalgamate quotes from top 12 exchanges to provide the best rates for our end users, be it borrowers or lenders.

Fee Structure

Every borrow is subject to a borrow fee. This is hardcoded to 0.2% at the moment. The fee will be added to the total borrowed and reflected onto the users dashboard accordingly. These fees will be accumulated and added to protocol reserves. This fee is intended to serve as a "safeguard" to prevent abuse of short-term borrowers. The fee rate will be subject to change via Governance voting.

Risks

Given the nature of the interest rate model and its ability to dynamically adjust itself based on market conditions. It is crucial that both borrowers and lenders understand the model described above to avoid high interest rates and/or liquidations.



The PBX Token

From the recent inception in 2016 of the decentralized autonomous organization, or DAOs for short, there has been much interest in how these protocols can solve problems that pertain to business models. Creating a company or business model that allows for a decentralized structure of power can be a difficult task. DAOs help resolve many of these issues by distributing power to make changes from the top executive to any stakeholder in the company. Other benefits of a DAO come from its autonomous nature, once implemented there is no leeway for human error or not following through on an agreement. We believe in the power of decentralization and group collaboration.

With this in mind, we created the PBX governance token. The purpose of this token is to facilitate decentralization in a way that allows all holders to participate in changes to the protocol.

Owners of PBX can create and vote on various proposals with the goal of improving the protocol. Creating this feedback loop will help incentivize positive changes and further the relationship between the protocol and the stakeholders. Additional features of the PBX token is its fee sharing aspect. Holders will be able to gain a percentage of fees generated. This will be distributed proportionately to those who have more tokens. Stakeholders benefit by receiving value for holding all while encouraging continual holding.



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